Amendments to the Specification

Please amend the paragraph on p.1, lines 12-17, as follows:

The present invention relates generally to a method for optimizing the multivariate allocation of resources. In particular, ~~the present invention provides~~ various implementations of the invention may be usable to provide a method for finding an optimum level of resources that will support a desired level of production of refinements being produced from those resources. Conversely, various implementations may also allow ~~the present invention also allows~~ for finding a level of resources that will support an optimum level of production refinements produced from the resources.

Please amend the paragraph on p. 5, lines 2-9, as follows:

~~To achieve the foregoing, and in accordance with the purpose of the present inventive~~ A method is disclosed that provides an efficient optimization solution to a closed form expression that has been derived for the multivariate allocation of resources. In particular, a method is provided for an efficient unconstrained and nonlinear constrained optimization solution to the multivariate allocation of resources to meet manufacturing needs for uncertain multiproduct demand, where uncertainty is captured through a multivariate normal distribution over product demand (or more generally, any member of the elliptical family of distributions).

Please amend the paragraph on p. 6, lines 4-16, as follows:

According to various teachings of ~~the invention disclosed in~~ the above-incorporated prior application, and equally applicable to the present application, relevant models and associated

equations are formulated[[,]] according to a "plan" ~~for the present system~~, wherein the resulting equations are solved for certain values (or ranges). The models or plans might consist of a set of resources (e.g., components) and a set of refinements of those resources (e.g., products). The resource consumption is based on a linear relationship between each refinement and its set of supporting resources (e.g., the bill of materials for a product). Each resource is typically shared among several refinements. There is a demand distribution for the refinements that can be a multivariate normal distribution (e.g., future product demand for next quarter, or the like). More generally, this distribution can be any member of the elliptical family of distributions, of which the multivariate normal distribution is an example. ~~such an example member.~~ The following discussion will reference and work with the example multivariate normal distribution, but the present method is not intended to be limited only to such distributions.

Please amend the paragraph on p. 6, line 25 to p. 7, line 7, as follows:

~~According to the present invention, the~~ The resulting closed form expression [[is]] can be further processed to provide a deterministic solution for optimization of the closed form expression. The EVF resulting from any modeled plan is transformed to be a series (or sum) of products, which is the closed form expression. This process involves transforming the original product space, referred to as "X" herein, to a different space referred to as "Z" herein. In general, this transforming step involves taking a transformation of the product space to provide the working transformed space wherein the transformation can include any that maps the distribution induced on the resources (or components) by the product demand distribution into a distribution with zero mean and unit variance. One such example transformation includes an inverse

Cholesky transform. While the inverse Cholesky transform will be referred to herein for example purposes, the present invention is not intended to be limited to only this transformation. As a result, the linear transformation "Z" is an inverse Cholesky transform of the "X" space. The resulting EVF is a summation of product functions and component functions. The product functions include, for example, revenue and price functions. The component functions account for factors such as erosion, expediting, and/or penalty costs.

Please amend the paragraphs on p. 11, line 5 to p. 12, line 20, as follows:

Figure 1 shows~~, according to on aspect of the present invention,~~ an example system configuration that might utilize the optimization method described herein.

Figure 2 shows~~, according to one aspect of the present invention,~~ a multi-element influence diagram with multiple horizontal and vertical interactions between the elements.

Figure 3A shows~~, according to one aspect of the present invention,~~ a typical price elasticity curve of the mean mu versus price p.

Figure 3B shows~~, according to one aspect of the present invention,~~ a typical Expected Value function to be maximized, over a component vector d, or mean vector mu.

Figure 4 shows~~, according to one aspect of the present invention,~~ a graphical representation of a plan in the Z space, as transformed from the X space.

Figure 5A shows~~, according to one aspect of the present invention,~~ a typical monotonically increasing product function $f_i (Z_i)$.

Figure 5B shows~~, according to one aspect of the present invention,~~ a typical concave component function $g_j(d_j)$.

Figure 5C shows~~, according to one aspect of the present invention,~~ a typical curve resulting from the substraction of the $g_j(d_j)$ curve from the $f_i(Z_i)$ curve (i.e., $f_i(Z_i) - g_j(d_j)$).

Figure 6 shows~~, according to one aspect of the present invention,~~ a graphical depiction of a simple plan with the certain aspects of Loading applied to facilitate description of the Loading step.

Figure 7 shows~~, according to one aspect of the present invention,~~ a graphical depiction of a simple plan, with a first and second alternative resulting from the Loading Step, depending upon which components d gate elements Z.

Figure 8 shows~~, according to one aspect of the present invention,~~ graphical depiction of the simple plan above being guided through the Loading and Re-Loading steps to produce an Equilibrium Configuration, with the result being a Merged block which can be maximized over a single variable Z.

Figure 9 shows~~, according to one aspect of the present invention,~~ a more complex plan which results in a plurality of blocks after the Loading and Reloading steps are used to produce an Equilibrium Configuration, with each block being maximized over a single variable.

Figure 10 shows~~, according to one aspect of the present invention,~~ a flowchart of certain representative steps that might be used to applied the optimization method, including the Loading and Re-Loading Steps.

Figure 11 shows~~, according to one aspect of the present invention,~~ a flowchart of certain representative steps that might be used to perform the Loading Step, shown as an element in Figure 10.

Figure 12 shows~~, according to one aspect of the present invention,~~ a flowchart of certain representative steps that might be used to perform the Re-Loading Step, shown as an element in Figure 10.

Please amend the paragraphs on p. 13, lines 1-13, as follows:

DETAILED DESCRIPTION ~~OF THE INVENTION~~

<u>The following discussion includes</u> ~~The present invention relates generally to~~ a method for optimizing the multivariate allocation of resources. ~~In particular, the present invention provides a method for taking~~ <u>In one implementation, the method takes</u> a multivariate expected value function as a closed form expression, and optimizing the expression in a deterministic manner. <u>Also described is</u> ~~The present invention provides~~ a method for finding an optimum level of resources that will support a desired level of production of refinements being produced from those resources. Conversely, <u>various techniques also allow</u> ~~the present invention also~~ allows for finding a level of resources that will support an optimum level of production refinements produced from the resources. The method provides for an efficient unconstrained and nonlinear constrained optimization solution to the multivariate allocation of resources to meet manufacturing needs for uncertain

multiproduct demand, where uncertainty is captured through a multivariate normal distribution over product demand (or more generally, any member of the elliptical family of distributions).

Please amend the paragraph on p. 13, lines 15-21, as follows:

Figure 1 shows a block diagram 100 with ~~of certain representative elements that might comprise the system of the present invention, as described further in the prior referenced application. This diagram shows~~ a main element 102 with data (or information) going in, and resulting information coming out. The aggregation and treatment of such data is further detailed below. Examples of historical data flowing into the system include Product Demand Data 104, which would include bookings, shipments, etc. Historical data might also include Component Consumption Data 106.

Please amend the paragraph on p. 15, lines 12-21, as follows:

The optimization step 122 optimizes, or finds a maximum of, ~~is therefore addressed herein by the present invention. The general premise is to provide a method for optimizing, or finding a maximum, of~~ the EVF. Referring now to Figure 2, this complex structure or plan 200 (also referred to as an influence diagram) will have a non-linear, multivariate normal distribution function (i.e., EVF) associated with it. This multivariate normal distribution function represents the multivariate allocation of resources to meet manufacturing needs for uncertain multiproduct demand, where uncertainty is captured through a multivariate normal distribution over product demand. More generally, the distribution might include any member of the elliptical family of distributions. The present

method thereby provides for an efficient unconstrained and nonlinear constrained optimization solution to the multivariate allocation.

Please amend the paragraph on p. 20, lines 10-18, as follows:

Referring to block 604, it becomes necessary to determine which component "Gates" element Z_1. The gating function is determined by the "h" function (see again ~~formula 4~~ Eqn. 6), which accounts for the connect rates and interactions between the resources and refinements. In this example, if the connect rates are the same, then a key result operates from the fact that the amount of d_1 and d_2 that are needed to support Z_1 has to be the same. For instance, if Z_1 is a computer and needs a keyboard and monitor to build one unit, then at the maximum of Z_1, the number of keyboards and monitors has to be the same. If there are more monitors left over than keyboards, then this cannot be a level to support maximum revenues because the surplus of monitors is going to experience erosion (and increase costs).

Please amend the paragraph on p. 21, lines 7-9, as follows:

which is a function of three variables Z_1, d_1, and d_2. By using the appropriate "h" translation function (see again ~~formula 4~~ Eqn. 6) to translate each d_1 and d_2 into the appropriate variable Z_1, the EV function can be rewritten as:

Please amend the paragraph on p. 26, lines 10-27, as follows:

The method described above can similarly be represented in the form of flowcharts to describe the process steps. Referring now to Figure 10, a flowchart 1000 is shown of certain representative process steps used to find an optimum solution for an EV function. In step 1002, the EVF is converted to a closed form expression as per

the apparatus and method described in the prior referenced application. A linear transformation, i.e., inverse Cholesky or the like, is applied in step 1004 to convert the X-space of the products to the Z-space required for the optimization solution. The Loading step ~~of the present invention~~ is applied via step 1006, to recursively determine blocks of elements Z, as gated by the various components d. In step 1008, the Re-Loading step is performed to properly account for any Unloaded components, and to thereafter Merge various elements together into a single block is necessary. After the Loading and Re-Loading steps, the resulting configuration will be in equilibrium, and is hence referred to as an Equilibrium Configuration. In step 1010, the EV function resulting from each block of the Equilibrium Configuration are maximized, with a level Z resulting from each maximization. In step 1012, the component levels (i.e., values of d) can be computed from the resulting values of Z, via "backing out" each set of d components from each Z element through inverse transforms. The resulting levels of d will thereby be capable of producing enough products X to maximize the associated EVF for the system or plan.